

## Telemetry signal collection, process and provision equipment

This patent refers to an electronic equipment unit, which collects, process and transfers data from a certain area, which it monitors, to a telemetry system. Data are collected from various intrusion monitoring sensors (e.g. infra-red or microwave detectors), water level detectors, smoke detectors, electrical supply watchdogs etc. These data are suitably processed by the unit and the output is sent to a telemetry system via an external interface box. This unit is aimed primarily to be used inside cellular telephony antenna shelters and more particular in sealed type outdoor shelters which have a total space in the order of 3 m<sup>3</sup> in contrast of the normal shelters which have the dimensions of a small room (about 35 m<sup>3</sup>). This electronic equipment unit consists of a metal case with detachable cover, an electronic printed circuit board, a lead battery, a 230/18 VAC transformer, interconnection wiring, special type supply and data cables.

Today, similar equipment which collect, process and transfer data from a certain area which they monitor, to a remote information collection system sited at a great distance, are not specifically designed and manufactured for the above mentioned intended application inside cellular telephony antenna shelters. Existing units are either general industrial control central units or security system central units modified to serve the data collection, process and transfer needs.

This results to non conformity with the international safety rules (CE), as well as that the above equipment are not certified for the intended use, with repercussions in case of accidents and interruption of the uninterrupted operation of the cellular telephony shelters.

Moreover, existing units have to use external autonomous sensors, in which the process logic is situated inside the data processing electronic circuit and simply signal the central unit. This leads to a mixture of different, distributed processes, almost impossible to modify or adapt to specific requirements and a variety of hardware, which is difficult to service or maintain.

In addition, as these existing units are not designed to fit inside the sealed type outdoor shelters, cannot be used as such, leaving the shelters without monitoring infrastructure (capabilities). This in turn results to increased operation and maintenance costs of the sealed type outdoor shelters, as they lack monitoring infrastructure, and also that the operators are not able to prevent failures or identify arising problems, so that the appropriate and properly equipped suitable personnel is engaged to deal with it.

This invention provides the following novel characteristics:

- 1) It integrates on one printed circuit board (PCB) the processor and the logic circuits of a variety of sensors. As a result, the overall size of the monitoring system is minimized, saving valuable space to the applications where it is installed (e.g. in cellular telephony antenna shelters) and has the unique capability to be installed inside sealed cellular telephony antenna shelters (outdoor shelters).
- 2) The logic circuits are integrated on the main PCB (fig. 1 KINTEC - KODU1) whereas all the sensors are external and do not require to have own logic, because they use the logic of the PCB. (Fig. 1 and 2)

- 3) Another advantage is that it is not required to purchase extra logic / control electronic circuit boards to interface with the various sensors, as these are included in the main PCB thus significantly cutting down the cost of the monitoring system.
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- 4) The unit is custom designed and built to be used in cellular telephony stations (e.g. GSM) having extreme space limitations. This also results in full compliance with the E.U. safety specifications, as the unit is ready to be installed "as is" (e.g. in cell-phone shelters), without any
- 10 tampering or modifications, like holes in the case, addition of extra electronic boards, change of power supply source etc
- 5) The volume and dimensions of the unit together with the choice of two alternative support methods allow it to fit in all known types of sealed
- 15 type (outdoor) cell-phone shelters.
- 6) Build-in 3-phase (RST) mains watchdog with capability of logic "OR" or "AND" signaling.
- 20 7) Separate "DOOR OPEN" output which indicates the state of the shelter's doors, adds in security and ease of operation. The combination of "DOOR OPEN" and "INTRUDER" alarms provide the operator with enough information to distinguish between an accidental case and an intentional (intruder) attempt
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- 8) Build-in temperature monitor circuit with two set levels for both "Hi" and "Low" temperature alarms
- 9) Build-in moisture / water level monitor circuit for flood alarm signaling

10) Two independent “free” relays on the printed circuit board for use when special or extra signaling is required.

- 5 11) Capability of easy software changes in order to meet future requirements.

The functions of the electronic unit are the following:

- 10 1) Check of R-S-T phase presence:

If any of the three main's phases is interrupted, a corresponding relay is released (de-energized) and the opening of its contacts signals the relevant alarm to the telemetry system (total 3). If the “serial-parallel” selector is in the “serial” position an additional “A/C BREAK” alarm is generated when  
15 any phase is interrupted (logic “OR” operation). If the selector is in the “parallel” position, the “A/C BREAK” alarm is generated only if all 3 phases are missing (logic “AND” operation).

Irrespective of the above, mains supplying the unit is also monitored and the “MAINS OK” relay is held energized with LED L3 lit. When mains  
20 supply to the unit is interrupted for more than 20 seconds, L3 is extinguished and the relay is released signaling a relevant alarm (see fig. 3 logic subroutine “RST”).

- 2) Battery check:

25 As long as the voltage at the battery terminals is greater than 10.8 VDC the “LOW BATTERY” relay is held energized and LED L2 is lit. When voltage drops below 10.8 VDC, L2 is extinguished and the relay is released signaling a “LOW BATTERY” alarm (see fig. 2 logic subroutine “LOW BATTERY”).

Note: This function only works when system runs on batteries (no mains present) as at all other times the battery is under charge.

3) Moisture "FLOOD" monitoring:

- 5 1.5 seconds after the corresponding sensor becomes wet, the "FLOOD" relay energizes signaling a "FLOOD" alarm until the sensor is dry again for more than 5 seconds (see fig. 4 logic subroutine "FLOOD").

Note: This function only works when system is powered from the mains

10 4) System "ON/OFF":

When the unit receives an "ON" command from the external keypad, then:

4a) Resets the fire detectors by energizing the "FIRE DETECTOR RESET" relay for 2 seconds (see fig. 7 logic subroutine "FIRE RESET").

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4b) Loads the pre-set (selector ST1) "EXIT TIME" delay. This delay has a step of 7.5 sec and maximum value 120 sec. During this time, the buzzer on the unit is sounded continuously.

- 20 4c) After "EXIT TIME" expires, the unit checks the resistance of zones 1 and 2 (Balance). If the resistance is within limits (around 1800 ohms) the unit de-energizes the buzzer, energizes the "ON/OFF" relay arming the system and signaling the "ON" state. If the zone(s) are not balanced then the unit loads the preset "FAULT" delay (selector ST2) and sounds the
- 25 buzzer with a pulsing rate. This delay has a step of 7.5 sec and maximum value 120 sec.

4d) If the zone(s) are still out of balance at the end of the "FAULT" cycle, then the unit stops the buzzer leaving the ON/OFF relay and the system in un-energized (OFF) state. (see fig.6 logic subroutine "ON/OFF").

5) Check of the area surveillance zones 1 and 2:

During the time the system is "ON" the unit monitors zones 1 and 2.

Zone 1: If zone 1 becomes unsettled, the unit loads the preset "ENTRY TIME" delay (selector ST4 with a time step of 7.5 sec and maximum 120 sec) and sounds the buzzer. If at the end of this delay the zone is still  
10 unsettled, the unit energizes the "INTRUDER" relay sending the corresponding alarm to the telemetry system.

Zone 2: If zone 2 becomes unsettled, the unit checks the state of "DELAY 1" preset. If it is set to "DELAY" position then sequence followed is the same as for zone 1. In other case the "INTRUDER" relay is energized  
15 immediately without any sound warning. (see fig. 8, 9 & 10 logic subroutines "ZONE1", "ZONE2" & "INTRUDER").

6) "LATCH" function:

If the "LATCH" function has been selected, the "INTRUDER" relay  
20 remains energized until the unit is set to "OFF" state from the external keypad.

If the "LATCH" function has not been selected, the "INTRUDER" relay remains energized for a predetermined "ALARM TIME" set by selector ST3.

25 This time has a step of 37 seconds and can take a maximum value of 600 seconds. (see fig. 10 logic subroutine "INTRUDER").

7) "DOOR OPEN" function:

This independent function closely monitors the state of both zones 1 and 2 and if any becomes unsettled "DOOR OPEN" relay signals a relevant alarm to the telemetry without any delay and for as long as the problem persists.

5 8) Battery charging:

The unit incorporates a suitable circuit for the automatic charging of its battery which is 12V 2.2 AH. (see circuit description section Para. 4)

9) "Feed troughs":

- 10 On the printed circuit board of the unit there are two spare relays RELA1 and RELB1. Their coils and contacts are available at the connection posts and can be selected to be "normally open" (N/O) or "normally closed" (N/C) via selectors SELECT1 and SELECTB1.

- Also on the printed circuit board there are a number of direct connections  
15 between connectors aimed to ease wiring and routing of certain telemetry signals not requiring processing. These are described in the "KINTEC OUTDOOR UNIT INTERCONNECTION" diagram and shown in the printed circuit board schematic

- 20 Description of the electronic diagram of the unit (fig. 13-20)

The electronic circuit consists of the following parts / sub-circuits:

- 1) The microprocessor core parts are the integrated circuit (U1)  
25 AT90S8515 microprocessor, crystal (Y1), capacitors CC1, CC2, CWA1, C1 and the watchdog integrated circuit (U2).

Circuits that are controlled by the microprocessor are:

- 1a) Time delay circuits EXIT, FAULT, ALARM and ENTRY TIME consisting of parts: ST1, ST2, ST3, ST4, AR1 and AR2.
- 1b) Selection of delayed operation of zone 2 (DELAY1, RDE) and intruder relay latch (LATCH, RM1).
- 1c) Zone1 and zone2 ON-OFF monitoring circuits consisting of parts: J-INB1, J-INA1, CZ1, CV1, CO1, CZ2, RZ1, RZ2, RS11, RON2.
- 1d) Zone balance control circuits consisting of parts: RS1, RS2, RS4, RS5, RS8, RS9, RS3, RS7, US1 and US2.
- 1e) Mains monitoring circuit. Parts D1, Z2, R1 and C2.
- 1f) Microprocessor data output circuits controlling INTRUDER, DOOR OPEN, ON-OFF, FIRE RESET, MAINS OK and BUZZER relays, consisting of the relevant parts: RI1, QI1, KIND1-RD1, QD1, KD1-RON1, QON1, KON1-RF1, QF1, KF1-R2, R3, L3, Q4, K5-RBU1, Q3, CBUZZ1, DBUZZ1, LS1.
- The dry-contact outputs of the relays above are available at the connectors CONNA1, CONNB1, J-INA2 and J-INB2 and are consequentially routed via the interface box to the telemetry panel.
- 2) Analog circuits independent from the microprocessor, monitor the battery voltage (LOW BATTERY), moisture (FLOOD) and the 3 phases (RST) and consist of parts: RB2, RB3, RB4, RB5, RB6, RB1, RK2, Q2, L2, K2 (LOW BAT), RW1, RW2, RW3, RW4, RW5, RK1, RZE1, CW1,

CW2, Z1, Q1, K1, L1, UW1 (FLOOD) and LS2, LS3, LS4, RST1, RST2, RST3 (RST).

3) Feed through circuits consisting of: RELA1, RELB1, SELECTA1 and  
5 SELECTB1 and interconnections between connectors CONNB1, J-INA3 and J-INB3

4) Power supply and battery charging circuits consisting of: F1, F2, F3, F4, F5, RV1, CMAIN2, L4, CMAIN1, RP1, RP2, RP3, RP4, RP5, CP5, CP4,  
10 CP2, CP3, D2, DP1 and DP2

The way that all circuits operate and co-operate between them is analytically presented in the included logic diagrams and in the detailed operational description of the unit  
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### The Case

The unit is housed in a metal case accommodating a) the printed circuit board (PCB), b) the supply transformer and c) the battery (fig. 24, 25).

The case supports and protects the above from external environmental  
20 elements, provides safety to personnel, and acts as an electromagnetic shield to and from the environment (EMI/EMC).

The dimensions of the case are 290X225X76 mm. It consists of a main body and a removable cover secured with 4 screws on corresponding  
25 threads bonded at the main body corners.

The case is manufactured from rolled iron sheet (dcp) of 1.0mm thickness for the main body and 0.8mm for the cover and is electrostatic painted to a thickness of 60 microns.

Inside the main body of the case are bonded: threads for the cover, supports for the printed circuit board, a metal duct for the 220V mains cable, battery support, transformer mounting posts as well electromagnetic and safety  
5 grounding posts.

The cover is also equipped with a bonded grounding post for increased electromagnetic shielding and safety.

On the upper and lower sides of the main body (225X76mm) there are 10  
10 openings with plastic liquid tight cable strain relief for the secure and safe cable exit/entry to and from the peripheral devices.

On the side of the main body of the case (290X76mm) there are bonded angled metal strips with holes for supporting the unit when installed in  
15 racks. Alternatively a separate metal two part split brace is available to enable wall installation if required.

The case is secured with an anti-tamper switch, which signals a corresponding illegal tamper alarm if the case is opened by non authorized  
20 personnel

The above description refers to the attached schematics, which show the preferred realization of this invention. Other realizations or modifications are possible if they do not part from the spirit and scope of this invention.

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For example, various combinations of sensors can be used to meet different monitoring needs. Furthermore, this invention can be used in an antenna shelter of any system and generally where a space problem exists. As a result, the present analytical description is explanatory and does not confine

the invention. The scope and spirit of the invention are defined in the attached claims.